CALIFORNIA STATE LIBRARY
SCANNING STANDARDS

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I. Introduction:

Many of California's 8000 libraries, archives, museums, and historical societies hold unique resources. Most, if not all, of these resources are accessible to those Californian's who visit these local institutions. Identifying what resources are owned by whom and gaining access is a major barrier to widespread use these resources. Additionally many of these unique resources are in a fragile condition, further limiting access to all but a few librarians, scholars, archivists and curators. Expanding access to these unique resources is a cornerstone of the Library of California Initiative. Through a variety of California State Library funded initiatives, including creation of finding aids, retrospective conversion of indexing and cataloging information, and reformatting to digital images, access is being increased.

Through digital imaging, people from all parts of California, and the world, can access these resources when they are made available via the Internet. Digital presentation reduces physical access to these fragile resources, extending the life of the original, while increasing access. Access and preservation objectives can be met through these digitization initiatives. As the State embarks on a variety of initiatives to expand access to, and preservation of these special collections, it is felt that standards for the creation of digital images is needed.

A working group of librarians, archivists and curators reviewed a variety of scan standards, including standards developed by the California Digital Library, the Library of Congress and National Archives and Records Administration. The working group recognized that a wide variety of institutions would be using these standards and that the institutions would have a variety of formats, purposes for scanning, and technical expertise. The group decided to recommend standards that establish a minimum scanning criteria. It is recommended that the institutions scan at the highest level appropriate for the item, which will be greater than the minimum recommended standards. These standards can be applied by institutions whether they are receiving state library funding/grants or funding projects through non-state library revenue.

These scanning standards represent the best practices as of November, 1999. They will be reviewed annually and updated as required.

II. Purpose:
The purpose of this document is to provide a minimum set of scanning standards for use by California libraries/museums undertaking digitization projects. This document address the following formats:

- Text
- Photographs
- Maps
- Graphic materials
- Three-dimensional materials represented in two dimensional format

It does not currently address the needs of oversized materials, bound materials, three-dimensional materials, born digital objects, audio or video resources.

The following scan standards have been developed to:

- Provide guidance to a wide variety of California institutions applying for California State Library administered grants or funding';
- Ensure a consistent and high quality image across various initiatives;
- Decrease the likelihood of rescanning;
- Increase the likelihood that the image can be reused for future applications; and
- Encourage widespread and convenient access to digital images by supporting use of standard formats that are widely accepted.

These recommendations are purposely broad to apply to a variety of institutions and collections. These standards are not to be used as the **de facto** standard for digital imaging, but as guidelines for image capture, presentation and storage. Unique characteristics of individual resources may necessitate different approaches to scanning. Conversion requirements for each project must be considered on a case by case basis.

III. Scanning Standards:
These standards are **minimum** recommendations. They reflect best practices as identified by the community and will result in an acceptable level of image quality. Individual institutions must keep in mind future needs and consider scanning at higher level resolutions to assure maximum application in the future. Scanning should be done at the highest resolution appropriate for the materials and the intended audience and future use of the materials. Scanning at the highest possible resolution doesn't always gain significant benefits over the recommended level.

When scanning, it's recommended that the original, or first generation (i.e. photo negative vs. the print) be used to achieve the best quality image.

A. GENERAL RECOMMENDATIONS: Although many digitization projects are undertaken to increase access, the digital image as a preservation copy is a natural by-product. These standards consider these dual outcomes in making the following general recommendations:

- Consider current and future user needs, as well as the unique requirements of specific types of materials and collections;
- Scan at the highest resolution appropriate to the content of the original.
- Scan at a resolution level to avoid rescanning in the future.
- Create and store master image, allowing for production of derivative images for current and future use.
- Use standards that are international, industry based and non-proprietary.
- Current distribution technology limitations should not determine levels of scanning.
- Use system components that are non-proprietary.
- Create appropriate backup files and store media in an appropriate environment.
- Develop a migration plan to assure successful transfer across technology generations.
- Consider grayscale over bitonal; color over grayscale.

- Use objective measurements to determine scanner settings. Do NOT attempt to make the image look good on a particular monitor or use image processing to correct color.
- Do not compress digital masters, unless a lossless compression is used.
- Capture metadata about the scanning process, as well as the descriptive metadata.

These general recommendations were developed by the California Digital Library as part of their *Digital Image Collection Standards.*

B. RECOMMENDED STANDARDS: This document provides minimum scanning recommendations for responsible conversion and to achieve an acceptable level of image quality. The user must recognize that collections will have different requirements, as they differ in purpose and clientele. These standards will serve as a guide, rather than a set of hard and fast rules. As a rule, the key to quality scanning is to scan at the resolution that matches the information content of the original, not necessarily at the highest resolution possible.

1. Image files: **It is recommended that three versions of an image be created: a master image, an access image, and a thumbnail image.** A higher resolutions access image may be created should a high degree of detail in the image be needed. It is recommended that this version be maintained in addition to the master image version.

a. Master/archival image file: Many digital imaging projects scan a high-quality 'master' or archival image and then derive additional versions in smaller sizes or alternative formats for a variety of uses. There are compelling preservation, access and economic reasons for creating an archival quality digital master image. These include:
   - The master image provides an information-rich, unedited, research quality surrogate, and offers the greatest likelihood that rescanning will not be necessary in the future.
   - A high quality master image will make the investment in the image capture process worthwhile.
   - A digital master is available and rich enough to accommodate future needs and applications.

   The master image should be the highest quality you can afford. It should not be edited or processed for any specific output. It is recommended that the compression should be lossless/uncompressed, allowing future uses to take advantage of data that currently is not eye-readable. New software is available that supports lossless compression. Testing use of this new software is recommended prior to adoption. Quality control standards should be applied in creating master image files. Master image files can be very large, increasing the cost of online storage, so offline storage, either DVD or CD may be preferable.

b. Derivative Image Files: Derivative files are created from the master digital image. Derivative files typically include an access image, which is sized to fit within the screen of an average monitor, and a thumbnail image, which is usually quite small and hotlinked to the larger access image. Derivative image files are usually stored online, providing an acceptable response time in retrieving the image. An alternative is to store these files on DVD or CD.

The following table is from the Colorado Digitization Project *General Guidelines for Scanning*

Master Image	Access Image	Thumbnail Image
• Represents as closely as possible the information contained in the original • Uncompressed • Unedited	• Used in place of master image for general web access • Generally fits within viewing area of average monitor • Reasonable file size for fast download time; does not	• A very small image usually presented with the bibliographic record • Designed to display quickly online; allows user to determine whether they want to view access image

• Serves as long term source for derivative files • Can serve as surrogate for the original • High quality • Very large file size • Used for creating high quality print reproductions • Usually stored in the TIFF file format	require a fast network connection • Acceptable quality for general research • Compressed for speed of access • Usually stored in JPEG file format	• Usually stored in GIF or JPEG file formats • Serves as long term source for derivative files • Not always suitable for images consisting primarily of text, musical scores, etc.; user cannot tell what content is at so small a scale

2. Types of scanning: There are three types of scanning:

- Bitonal--One bit per pixel representing black and white. Bitonal scanning is best suited to high-contrast documents such as printed text.
- Grayscale--Multiple bits per pixel representing shades of gray. Grayscale is suited to continuous tone documents, such as black and white photographs.
- Color--Multiple bits per pixel representing color. Color scanning is suited to documents with color information.

These three modes of scanning require some subjective decisions. Documents, including black and white text with color marks, manuscripts, older printed matter and sheet music, might be scanned in color to bring out special meaning or information identified through the color notations and markings. Although bitonal scanning is often used for typed scanning as continuous tone in grayscale or color to bring out the shade and condition of the paper and the marks inscribed on it.

C. MATERIAL FORMATS: The following defines the minimum standards based on the following format types, text, photographs, maps, graphic materials and three-dimensional materials represented in two-dimensional format.

1. Textual materials

Master Image:

- Tonal depth: Bitonal
- Format: TIFF
- Compression: Uncompressed
- Spatial Resolution: 600dpi

Access Image:

- Tonal depth: 8-bit grayscale or 24-bit color
- Format: JPEG
- Compression: Varies; 20-1 option
- Spatial Resolution:
  --Resize image to 640x480 pixels
  --OR 1024 x 768 pixels
  --OR 1280 x 1024 pixels
  --Range from 1000 pixels to 5000 pixels across the long dimension for higher resolution version

Thumbnail Image:

- Tonal depth: 4-bit grayscale/8-bit color
- Format: GIF
- Compression: Native to GIF format
- Spatial Resolution: Resize original to 150-200 pixels (+/-) across the long dimension (if thumbnail is applicable) 72 dpi.

Alternative Format: Portable Document Format (PDF) from Adobe (http://www.adobe.com) is an alternative format for creating and displaying text-based files on the web. Adobe Acrobat software must be used to create and manipulate files. The Adobe Acrobat viewer can be downloaded at no charge to view documents.

Other considerations: For handwritten manuscripts that are difficult to read, consider providing a transcript of the text. There are several ways to present digital images of text. The organization may wish to provide the text as an image file linked to a transcribed file, especially if OCR accuracy isn't reliable. Consideration must be given to the cost of keying the transcription. OCR software is available through Adobe as well as Caere Corporation (http://www.caere.com).

If text is kept as page images, a table of contents in HTML can be created and linked to the individual page images, providing easier navigation. If the text has been marked up with SGML, a fully searchable text may be provided enhancing usefulness of the content to scholars and researchers. SGML text can be converted to HTML, broadening access, as SGML viewers are not as widely available as HTML viewers.

2.Photographs:

Master Image:

- Tonal depth: 8-bit grayscale/ 24-bit or greater color
- Format: TIFF
- Compression: Uncompressed
- Spatial Resolution: 3000 to 5000 pixels across the long dimension

Access Image:

- Tonal depth: 8-bit grayscale/ 24-bit color
- Format: JPEG
- Compression: Depends: 7:1 - 10:1 for grayscale/10:1 - 20:1 for color
- Spatial Resolution:
  --Resize image to 640 x 480 pixels
  --OR 1024 x 768 pixels
  --OR 1280 x 1024 pixels
  --Range from 1000 pixels to 5000 pixels across the long dimension for higher resolution versions

Thumbnail Image:

- Tonal depth: 4-bit grayscale/8-bit color
- Format: GIF
- Compression: Native to GIF format
- Spatial Resolution: Resize original to 150-200 pixels (+/-) across the long dimension
- 72dpi

Alternative formats: Kodak's proprietary PhotoCD format has been used by some imaging projects for storing their photographic images. Information on Kodak PhotoCD can be found at http://www.kodak.com/us/en/digital/products/photoCD.html and in and article in RLD Diginews, :Using Kodak PhotoCD for Preservation and Access," at http://www.rlg.org/preserv/diginews/diginews23.html#feature. Other emerging file formats include the Flashpix format sponsored by Digital Imaging Group (http://www.digitalimaging.org)

Flashpix is a technology that provides a multi-resolution, tiled file format that allows images to be stored at different resolutions for different purposes, such as editing and printing in one file. Openpix technology is required to use Flashpix.

Portable Network Graphics (PNG) (http://www.cdrom.com/pub/png/) is an image format designed to replace GIF. It offers smaller file sizes than GIF, and does not lose information to compression. At this time there is not widespread use of this new format.

Other Considerations: Scanning photographs can present many challenges. It is recommended that the negative be used when scanning photographs, rather than the opaque image, as higher quality image can be achieved. Another consideration is to scan sepia-tone photos as color or black and white images. It is recommended that sepia-tone photographs be scanned as color images creating a better image. A larger file size will be created when scanning as a color image.

Another consideration with photographs is whether to scan the backs of the photos as separate images. If there is significant information on the back of the photo, that might not be available elsewhere, consideration should be given to scanning the verso of the photo.

3.Maps:

Master Image:

- Tonal depth: 8-bit grayscale/24-bit or greater color
- Format: TIFF
- Compression: Uncompressed
- Spatial Resolution: 300 dpi

Access Image:

- Tonal depth: 8-bit grayscale/24-bit color
- Format: JPEG
- Compression: Depends; 20:1
- Spatial Resolution:
  --1200 pixels across the long dimension (large maps)
  --Resize image to 640 x 480 pixels (smaller maps)
  --Range from 1000 pixels to 500 pixels across the long dimension for higher resolution version

Thumbnail Image:

- Tonal depth: 4-bit grayscale/8-bit color
- Format: GIF
- Compression: Native to GIF format
- Spatial Resolution: Resize original to 150-200 pixels (+/-) across the long dimension
- 72 dpi

Alternative formats: the Mr. SID (Multiresolution Seamless Image Database) format by LizardTech, Inc (http://www.lizardtech.com/products/mrsid/ allows for the compression, storage and retrieval of large digital images. Files are stored in proprietary format, .sid . The files are compressed with a 'wavelet' compression algorithm that provides a 'zoom in' capability in the browser software, and provides little loss in image quality. Lizard Tech provides viewers to those who wish to download and manipulate .Sid images. The technology can be delivered without viewers in standards JPEG.

4.Graphic materials in two and three-dimensional format:

Master image:

- Tonal depth: 8-bit grayscale/24-bit or greater color
- Format: TIFF
- Compression: Uncompressed

- Spatial Resolution: 3000 pixels across the long dimension or 300 dpi

Access Image:
- Tonal depth: 8-bit grayscale/24-bit color
- Format: JPEG
- Compression: Depends; 7:1 -10:1 grayscale; 10:1 - 20:1 color
- Spatial Resolution:
  --1200 pixels across the long dimension (large original)
  --Resize image to 640 x 480 pixels (small original)
  --Range from 1000 pixels to 5000 pixels across the long dimension for higher-resolution version

Thumbnail Image:
- Tonal depth: 4-bit grayscale/8-bit color
- Format: GIF (or JPEG)
- Compression: Native to GIF format
- Spatial Resolution: Resize original to 150-200 pixels (+/-) across the long dimension.
- 72 dpi

Standards for works of art are still developing. Usually artwork imaging projects involve scanning from photographic surrogates such as 35mm slides. If slides are used, follow recommendations for transparent photographs. For large format artwork, outsourcing to a vendor who has an overhead digital camera or a large flatbed scanner suitable for scanning large documents maybe more appropriate.

IV. Quality Control

A quality control program should be conducted throughout all phases of the digital conversion process. Inspection of final digital image files should be incorporated into the project workflow. Typically, master image files are inspected via CD batch or online for a variety of defects. Depending on the project, the project can inspect 100% of the master images, or inspect a random selection of the files. A 10% sample is generally used. It is recommended that quality control procedures be implemented and documented and that specific defects found unacceptable in the image be defined. Images should be inspected while viewing at a 1:1 pixel ratio or at 100% magnification or higher.

Quality is evaluated both subjectively by project staff through visual inspection and objectively in the imaging software. The viewing environment for visual inspection of images is also important. Monitors should be calibrated and the room should be dark or at least free from bright light, sunlight or glare. Things to look for during the visual inspection may include:

- Image is not the correct size
- Image is not the correct resolution
- File name is incorrect
- File format is incorrect
- Image is in incorrect mode, i.e., color image has been scaled as grayscale
- Loss of detail in highlight or shadows
- Excessive noise especially in dark areas or shadows
- Overall too light or too dark
- Uneven tonal values or flare
- Lake of sharpness/Excessive sharpening
- Pixilated
- Presence of digital artifacts, such as very regular, straight lines across picture
- Moiré patterns (wavy lines or swirls, usually found in areas where there are repeated patterns)
- Image not cropped
- Image not rotated or backwards

- Image skewed or not centered
- Incorrect color balance
- Image dull or not tonal variation
- Negative curve in the Look-up table
- Clipping black and white values (in histogram)

Other quality issues include CD Recording and Verification, file naming, scanner and monitor calibration, targets and color bars and storing images. Information quality control issues are addressed in a variety of texts listed in Appendix B.

Appendix A--Glossary

Archival Image--See Master/Archival Image

Bit Depth--See Dynamic Range

Compression/Decompression
The reduction of image file size for processing, storage, and transmission. The quality of the image may be affected by the compression techniques used and the level of compression applied. Decompression is the process of retrieving compressed data and reassembling it so that it resembles its original form before compression. There are two types of compression:

- **Lossless** compression is a process that reduces the storage space needed for an image file without loss of data. If an image has undergone lossless compression, it will be identical to the image before it was compressed. Primarily used with bitonal images.

- **Lossy** compression is another process that reduces the storage space needed for an image file, but it discards information (information that is "redundant" and not perceptible to the human eye). If an image that has undergone lossy compression is decompressed, it will differ form the image before it was compressed, even though the difference may be difficult for the human eye to detect.

There are both standard and non-standard compression techniques available. In general, it is better to employ a compression technique that is supported by standards, non-proprietary, and maintained over time. In selecting a compression technique, it is necessary to consider the attributes of the original. Some compression techniques are designed to compress text, others are designed to compress pictures.

Derived Image (Derivative Image)
An image that has been created from another image through some kind of automated process, usually involving a loss of information. Techniques used to create derived images include sampling to a lower resolution, using lossy compression techniques, or altering an image using image processing techniques.

Digital Image
An electronic photograph scanned from an original document, made up of a set of picture elements ("pixels"). Each pixel is assigned a tonal value (black, white, a shade of gray, or color) and is represented digitally in binary code (zeros and ones). The term "image" does not imply solely visual materials as source material; rather, a digital image is simply a representation of whatever is being scanned, whether it be manuscripts, text, photographs, maps, drawings, blueprints, halftones, musical scores, 3-D objects, etc

Dots per inch (dpi)
A measurement of the scanning resolution of an image or the quality of an output device. DPI expresses the number of dots a printer can print per inch, or that a monitor can display, both horizontally and vertically.

DPI-- See Dots per inch

Dynamic Range (Bit-depth)
The number of colors or shades of gray that can be represented by a pixel. The smallest unit of data stored in a computer is called a bit. Dynamic range is a measurement of the number of bits used to represent each pixel in a digital image. **1-bit or bitonal** means that a pixel can either be black or white. Bitonal imaging is good for black and white images, such as line drawings and text. However, scanning in grayscale rather than bitonal may produce a better looking image. **8-bit color** or **8-bit grayscale** means that each pixel can be one of 256 shades of color or one of 256 shades of gray. **24-bit color** means that each pixel can be one of 16.8 million colors.

File Format
A type of program or data file. Some common image file formats include TIFF, PICT, and EPS

GIF (Graphic Image File)
A widely supported image storage format promoted by CompuServe for use on the web

Gray Scale
A range of shades of gray in an image. Gray scales of scanners are determined by the number of grays, or values between black and white, that they can recognize and reproduce

Image Resolution
The number of pixels per unit length of image. For example, pixels per inch, pixels per millimeter, or pixels wide

JPEG
Joint Photographic Experts Group. A compression algorithm for condensing the size of image files. JPEGs are helpful in allowing access to full screen image files on-line because they require less storage and are therefore quicker to download into a web page.

JFIF (JPEG File Interchange Format)
A minimal file format which enables JPEG bit streams to be exchanged between a wide variety of platforms and applications.

Lossless--See Compression

Lossy-- See Compression

Master/Archival Image
An image meant to have lasting utility. Archival images are usually kept off-line on a cheaper storage medium such as CD-ROM or magnetic tape, in a secure environment. Archival images are of a higher resolution and quality than the digital image delivered to the user on-screen. The file format most often associated with archival images is TIFF, or Tagged Image File Format, as compared to on-screen viewing file formats, which are usually JPEGs and GIFs

Pixel
Often referred to as dot, as in "dots per inch". "Pixel" is short for picture elements, which make up an image, similar to grains in a photograph or dots in a half-tone. Each pixel can represent a number of different shades or colors, depending on how much storage space is allocated for it. Pixels per inch (ppi) is sometimes the preferred term, as it more accurately describes the digital image

PNG (Portable Network Graphics)
Pronounced ping. A new standard that has been approved by the World Wide Web consortium to replace GIF because GIF uses a patented data compression algorithm. PNG is completely patent and license-free.

Resolution
The number of pixels (in both height and width) making up an image. The more pixels in an image, the higher the resolution, and the higher the resolution of an image, the greater its clarity and definition (and the larger the file size). Resolution can also refer to the output device, such as a computer monitor or printer, used to display the image. Image file resolution is often expressed as a ratio (such as 640x480 pixels), as is monitor resolution; however, resolution is also expressed in terms of dots per inch (dpi). The assumed universal monitor resolution for web users is 72 dpi. Image file resolution and output (print or display) resolution combine to influence the clarity of a digital image when it is viewed.

Thumbnail
A small, low-resolution version of a larger image file that is used for quick identification or speedy editing choices.

TIFF (Tagged Image File Format)
The standard file format for high-resolution bit-mapped graphics. TIFF files have cross-platform compatibility.

TWAIN
Protocol for exchanging information between applications and devices such as scanners and digital cameras. TWAIN makes it possible for digital cameras and software to "talk" with one another on PCs

1-bit color
The lowest number of colors per pixel in which a graphics file can be stored. In 1-bit color, each pixel is either black or white.

8-bit color/grayscale
In 8-bit color, each pixel is has eight bits assigned to it, providing 256 colors or shades of gray, as in a grayscale image.

24-bit color
In 24-bit color, each pixel has 24 bits assigned to it, representing 16.7 million colors. 8 bits - or one byte - is assigned to each of the red, green, and blue components of a pixel.

32-bit color
A display resolution setting that is often referred to as true color and offers a color palette of over 4 billion colors or 2^{32}.

Appendix B--Resources

Besser, Howard. **Best Practices for Image Capture.** Word Document, 1999. http://sunsite.berkeley.edu/imagine/database/scanning/

Besser, Howard and Jennifer Trant. **Introduction to Imaging.** Santa Monica, CA, The Getty Art History Information Program, 1995. http://www.getty.edu/gri/standard/introimages/index.html

Besser, Howard. **Procedures and Practices for Scanning.** Canadian Heritage Information Network. http://sunsite.Berkeley.edu/Imaging/Databases/Scanning

California Digital Library. **Digital Image Collection Standards.** July 15, 1999. http://www.ucop.edu/irc/cdl/tasw/current/current.html

Colorado Digitization Project. **General Guidelines for Scanning.** July, 1999. http://coloradodigital.coalliance.org/scanning/html

Fleishauer, Carl. **Digital Formats for Content Reproductions.** Library of Congress. July 13, 1998. http://memory.loc.gov.ammem/formats.html

Kenney, Anne and Steven Chapman. **Digital Imaging for Libraries and Archives.** Ithaca, NY, Department of Preservation and Conservation, Cornell University Library, June 1996.

Macklin, Lisa. And Sarah L. Lockmiller. **Digital Imaging of Photographs: a Practical Approach to Workflow Design and Project Management.** Chicago, IL, American Library Association, 1999.

Puglia, Steven and Barry Roginski. **NARA Guidelines for Digitizing Archival Materials for Electronic Access.** National Archives and Records Administration, January, 1999. http://www.nara.gov/nara/vision/eap/digguide.pdf

Technical Advisory Services for Images. **Building Image Archives.** University of Bristol, United Kingdom. http://tasi.ac.uk/building/building2/html

APPENDIX C

Specific Minimum Recommendations--Besser, Best Practices for Image Capture

original material	digital master			screen display			print display		
	resolution in longest dimension	color depth	file format	resolution in longest dimension[1]	color depth	file format	resolution in longest dimension	color depth	file format
B/W text document	6000 pixels 3000 pixels[2]	8 bit grayscale	TIFF with lossless compression	1200 pixels 600 pixels	8 bit grayscale	GIF or JFIF	3000 pixels or 6000 pixels	8 bit grayscale	PDF or TIFF with LZW compression
Illustrations, Maps, Manuscripts, etc.	6000 pixels 3000 pixels	24 bit color	TIFF with lossless compression	300 pixels 800 pixels 1500 pixels 3000 pixels	24 bit color	JFIF, quality level 50	3000 pixels	24 bit color	JFIF, quality level 50-100
3-dimensional objects to be represented in two dimensions	6000 pixels 3000 pixels	24 bit color	TIFF with lossless compression	300 pixels 800 pixels 1500 pixels 3000 pixels	24 bit color	JFIF, quality level 50	3000 pixels	24 bit color	JFIF, quality level 50-100
35mm film, color negative or positive	6000 pixels 3000 pixels	24 bit color	TIFF or PhotoCD with lossless compression	300 pixels 800 pixels 1500 pixels 3000 pixels	24 bit color	JFIF, quality level 50	3000 pixels	24 bit color	JFIF, quality level 50-100
35mm film, B/W negative or positive	6000 pixels 3000 pixels	8 bit grayscale	TIFF or PhotoCD with lossless compression	300 pixels 800 pixels 1500 pixels 3000 pixels	8 bit grayscale	JFIF, quality level 50	3000 pixels	8 bit grayscale	JFIF, quality level 50-100
Medium to large format color photograph, negative, transparency or microfiche	6000 pixels 3000 pixels	24 bit color	TIFF or PhotoCD with lossless compression	300 pixels 800 pixels 1500 pixels 3000 pixels	24 bit color	JFIF, quality level 50	6000 pixels	24 bit color	JFIF, quality level 50-100
Microfilm, B/W	6000 pixels 3000 pixels	8 bit grayscale	TIFF with lossless compression	300 pixels 800 pixels 1500 pixels 3000 pixels	8 bit grayscale	JFIF, quality level 50	6000 pixels 3000 pixels	8 bit grayscale	PDF or TIFF with LZW compression

[1] The resource designer has considerable freedom to deviate from these recommendations to accommodate the presentation requirements of the individual collection.

[2] The lower resolution represents a minimum value. Material scanned at less than the minimum value is not considered to be archival quality. Every effort should be made to scan at the recommended, rather than the minimum, value.